

## REMARKS

### I. Introduction

In response to the Office Action dated July 15, 2005, subsequent to the Notice of Appeal submitted January 13, 2006, and in conjunction with the Request for Continued Examination (RCE) submitted herewith, claim 1 has been amended. Claims 1-2, 4-9, 11-17, 35 and 38 remain in the application. Re-examination and re-consideration of the application, as amended, is requested.

### II. Prior Art Rejections

In paragraphs (1)-(2) of the Office Action, claims 1-2, 4-9, 15-17, 35, and 37-39 were rejected under 35 U.S.C. §102(e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Goetz et al., U.S. Patent No. 6,441,393 (Goetz). In paragraphs (3)-(4) of the Office Action, claims 1-2, 4-9, 11-17, 35, and 37-39 were rejected under 35 U.S.C. §103(a) as being unpatentable over Goetz in view of Redwing et al., U.S. Patent No. 5,874,747 (Redwing). In paragraph (5) of the Office Action, claims 1-2, 4-9, 11-17, 35, and 37-39 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ishibashi et al., U.S. Patent No. 5,923,950 (Ishibashi) in view of Redwing or Edmond et al., U.S. Patent No. 5,739,554 (Edmond).

Applicants' attorney respectfully traverses these rejections.

As noted above, independent claim 1, and each dependent claim, were rejected as being anticipated by or, in the alternative, obvious in view of US 6,441,393 (Goetz).

However, claim 1 has been amended to recite a semiconductor film, comprising: a silicon substrate; and a single crystal graded gallium nitride layer deposited on the silicon substrate having a varying composition of a substantially continuous grade from an initial composition to a final composition and a net compressive stress.

Goetz, on the other hand, teaches a GaN buffer layer formed at low temperatures (e.g., 500 C), which produces an amorphous (i.e., non-single crystal) GaN buffer layer, rather than a single crystal layer as claimed. (See Goetz at column 3, lines 30-35.)

In addition, the Office Action notes that Goetz fails to disclose the combination of a Si substrate and a single crystal graded GaN layer. Applicants' attorney sees no reason why it would have been obvious to one of skill in the art to modify Goetz to include a single crystal graded GaN buffer layer on a silicon substrate as stated in the Office Action. Even if one

modified the GaN buffer layer in Goetz to be graded, the GaN buffer layer would not be single crystal as claimed.

Applicants' attorney also disagrees with the assertion that the lattice constant differences in Goetz would necessarily lead to a compressive stress because other factors also contribute to the net stress in a film. As noted in the background of the present application, the net stress also depends on a "thermal stress" component which arises from the thermal expansion mismatch when cooling from the growth temperature to room temperature. (See paragraph 8.) Relaxation effects associated with the lattice mismatch differences may also occur during growth which contribute to the net stress. Thus, the lattice constant difference, alone, would not necessarily lead to Goetz's GaN film having a net compressive stress. Moreover, Goetz fails to recognize the significance of generating a net compressive stress as it relates to crack suppression (or otherwise). In fact, Goetz even suggests that the films disclosed therein are under tensile strain (which can be reduced by using certain dopant combinations). (See Goetz at column 5, lines 51-52.) Accordingly, there is no reason to believe that the films disclosed in Goetz would necessarily have a net compressive stress as required to support an inherency rejection.

As noted above, independent claim 1, and each dependent claim, were rejected as being unpatentable over US 6,441,393 (Goetz) in view of US 5,874,747 (Redwing). The Examiner uses the same rationale in connection with claim 1 as in the rejection over Goetz - that the net compressive stress limitation would have been inherent in the combined structure because the differences in lattice constant throughout a graded layer inherently causes compressive stress.

For the reasons noted above, Applicants' attorney respectfully disagrees. Specifically, the combination of references does not teach a single crystal graded GaN layer. Moreover, the lattice constant difference, alone, would not necessarily lead to a GaN film having a net compressive stress. Applicants' attorney further points out that Redwing also fails to recognize the significance of generating a net compressive stress as it relates to crack suppression. There is no reason to believe that the combination of Goetz and Redwing would produce a structure having a single crystal graded GaN film that necessarily has a net compressive stress as required to support an inherency rejection.

As noted above, independent claim 1, and each dependent claim, were rejected as being unpatentable over US 5,923,950 (Ishibashi) in view of US 5,874,747 (Redwing) or US 5,739,554 (Edmond). The Examiner uses the same rationale in connection with claim 1 as in the two

rejections discussed above, namely that the net compressive stress limitation would have been inherent in the combined structure because the differences in lattice constant throughout a graded layer inherently causes compressive stress.

For reasons similar to those noted above, Applicants' attorney respectfully disagrees. Specifically, the combination of references does not teach a single crystal graded GaN layer. Moreover, the lattice constant difference, alone, would not necessarily lead to a GaN film having a net compressive stress. Applicants' attorney further points out that Ishibashi and Edmond also fail to recognize the significance of generating a net compressive stress as it relates to crack suppression. Moreover, it is unclear what the effect of the SiC converted Si substrate disclosed in Ishibashi, and relied upon in the Office Action, would have on the resulting stress of the film. There is no reason to believe that the combinations of Ishibashi and Redwing or Ishibashi and Edmond would produce a structure having a single crystal graded GaN film that necessarily has a net compressive stress as required to support an inherency rejection.

Thus, Applicants' attorney submits that independent claim 1 are allowable over Goetz, Redwing, Ishibashi, and Edmond. Further, dependent claims 2, 4-9, 11-35, and 37-39 are submitted to be allowable over Goetz, Redwing, Ishibashi, and Edmond in the same manner, because they are dependent on independent claim 1, and thus contains all the limitations of the independent claims. In addition, dependent claims 2, 4-9, 11-35, and 37-39 recite additional novel elements not shown by Goetz, Redwing, Ishibashi, and Edmond.

### III. Conclusion

In view of the above, it is submitted that this application is now in good order for allowance and such allowance is respectfully solicited.

Should the Examiner believe minor matters still remain that can be resolved in a telephone interview, the Examiner is urged to call Applicants' undersigned attorney.


Respectfully submitted,

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